ABSTRACT

An injection molding apparatus is provided. The injection molding apparatus comprises a manifold, a nozzle, a mold block, a valve pin, a first guidance and alignment structure, and a second guidance and alignment structure. The manifold has an inlet for receiving melt from a melt source. The manifold defines a runner that is downstream from the inlet and upstream from a manifold outlet. The nozzle defines a nozzle melt channel. The nozzle melt channel is downstream from the manifold outlet. The nozzle includes a nozzle body, a nozzle tip, a sealed piece, and a heater thermally connected to the nozzle body for heating melt in the nozzle melt channel. The nozzle tip and the seal piece are connected with respect to the nozzle body. The nozzle tip defines a portion of the nozzle melt channel. The thermal conductivity of the nozzle tip is higher than the thermal conductivity of the nozzle body. The thermal conductivity of the seal piece is lower than the thermal conductivity of the nozzle body. The mold block defines a mold cavity. The mold block defines a gate into the mold cavity. The gate is downstream from the nozzle melt channel. The gate includes a gate sealing surface. The mold block has at least one cooling channel therein for conveying a coolant therethrough for cooling the mold cavity. The mold block and the seal piece engage each other to inhibit melt leakage therebetween. A chamber is defined between the mold block, the nozzle tip, and the seal piece. The chamber is positioned downstream from the nozzle melt passage and upstream from the gate. The nozzle tip has sufficient surface area in the chamber to maintain melt in the chamber in a substantially molten state. The valve pin is movable into and out of the gate to control melt flow through the gate. The valve pin has a bottom end. The valve pin has a valve pin sealing surface proximate the bottom end. The valve pin sealing surface is engageable with the gate sealing surface to inhibit melt flow into the mold cavity. The first guidance and alignment structure is connected to the valve pin. The first guidance and alignment structure includes a first guide surface and first alignment surface. The first guide surface has a cross-sectional diameter that d creases gradually in a downstream direction. The first alignment surface is generally cylindrical. The

first guide surface is positioned immediately downstream from the first alignment surface. The second guidance and alignment structure is connected to the mold block upstream from the gate. The second guidance and alignment structure includes a second guide surface and a second alignment surface. The second guide surface has a diameter that decreases gradually in a downstream direction. The second alignment surface is generally cylindrical. The second guide surface is positioned immediately upstream from the second alignment surface. The second guide surface is positioned to engage the first guide surface to slide the valve pin into alignment with the gate when the valve pin is misaligned with the gate during movement of the valve pin towards the gate. The second guide surface is positioned to complete alignment of the valve pin with the gate prior to contact between the valve pin and the gate. The second alignment surface is positioned to engage the first alignment surface to maintain the valve pin in alignment with the gate during movement of the valve pin towards the gate.